

## **Jonsson School Undergraduate Research Experience Award Report**

### **Melanie Maurer, Dr. Heather Hayenga**

#### **Work Summary**

Under the supervision of Dr. Heather Hayenga during the Spring 2016 semester, I have completed several aspects of my project regarding macrophage mechanobiology. I have successfully employed traction force microscopy (TFM) techniques to analyze the forces which macrophages exert on substrates of varying stiffness. I synthesized polyacrylamide hydrogels of varying stiffness (1kPa, 3kPa, and 7kPa) with fluorescent latex microbeads to mimic a variety of stiffnesses which might be found in fibrotic tissues, and placed macrophages on each of these gels at a low density. I took fluorescent images of the gels with the macrophages, removed the macrophages using trypsin, and took a second set of fluorescent images of the gels after the macrophages were fully detached from the gel. I then used ImageJ software to analyze the bead displacement caused by the macrophage detaching from the gels, and found the forces exerted by the cells on the gels. I found that macrophages on stiffer substrates (3kPa) exert greater forces than those on softer substrates (1kPa), and that there is a maximum stiffness, below 7kPa, at which macrophages cannot exert a great enough force for bead displacement to be detectable. We hypothesize that macrophages exhibit a preferred stiffness at which they can exert a maximum force on their substrate, and that this preferred stiffness falls between 3kPa and 7kPa.

In addition to my TFM project, with the aid of the Jonsson Research Experience Award I have pursued a secondary project with one of my fellow undergraduates. We aim to explore the effects of substrate stiffness on macrophage cell area, proliferation, and rate of conversion to foam cells under varying conditions, including in exposure to yeast, non-oxidized LDL, and oxidized LDL. We completed a seven-day experiment at the end of April, and have since been working to analyze the data.

In May, I graduated with my B.S. in Biomedical Engineering, so I have finished my experimental work in Dr. Hayenga's lab and will be completing my project in the next few months by finishing my data analysis, giving a presentation on my work, and drafting a manuscript for publication.

#### **Summary of Achievements**

In April, I created a poster on my work with macrophage TFM, which I presented at the UGRA poster contest. Although I was not selected as a finalist in the contest, I had an excellent experience explaining my project to judges, faculty, and other students at the poster contest.

With the completion of this project, I submitted an abstract on my work to the Wilhelm and Else Heraeus-Seminar on Cellular Dynamics in Bad Honnef, Germany in September. I have recently been selected to give a poster presentation on my work at the seminar, and will be working over the next month and a half to prepare a poster for this presentation.

Finally, with the guidance of Dr. Hayenga, my lab mate and I will be drafting a paper for publication on both of our individual work, as well as the joint project I have described above. We aim to publish my work since I joined the lab in Fall of 2014, including my TFM project from this year's UGRA and the Jonsson Research Experience Award, my project on macrophage proliferation from last year's UGRA, and the joint project which I am finishing now. We hope to have this paper published during this fall semester.